

REMARKS

By the above actions, new claims 69-81 have been presented, the dependency of claims 34-36 and 39-46 changed to claim 69, and claims 1-34, 37, 38, and 47-68 canceled. It is also noted that new claims 71-81 are the same as claims 34-36 and 39-46 except that they depend from new claim 70, which is the same as claim 69 except for the upper limit of the absolute pressure range. Support for the limitations of claims 69 and 70 that were not present in the original claims can be found in paragraphs [0013], [0015] and [0020] of the present application. It is also noted that a further Information Disclosure Statement has been filed contemporaneous with the filing of this response. In view of these actions and the following remarks, reconsideration of this application is now requested.

With regard to the formal matters raised with respect to the claims, with the exception of that raised relative to claim 36, which has been addressed in the above amendment thereof, all have been rendered moot by the cancellation of claims 29, 31, and 67.

Claims 29, 31, 33, 35, 36, 38, 40, 41, 46, 62-65 and 68 were rejected under 35 USC § 102 based on the Yee et al. patent, while claims 30 and 32 were considered to be unpatentable under § 103 based on this patent. However, to the extent that these rejections might relate to the claims as now presented, it should be withdrawn for the following reasons.

As defined by the new claims 69 and 70, A membrane separation process for the enrichment of oxygen is recited in which a membrane separation system with a membrane separation unit having at least one membrane is used for separation of the air flow into a retentate, which is discharged on a retentate side of the at least one membrane, and a permeate, which is discharged on a permeate side of the at least one membrane by:

drawing the air flow into the membrane separation system directly from the atmosphere, compressing the air flow and then delivering the compressed air flow to the membrane separation unit at an absolute pressure of 1.35 to 1.5 bar,

permeating oxygen through the at least one membrane using a solubility-diffusion mechanism so as to enrich the oxygen concentration of the permeate by 22 to 45 volume percent, and

lowering the pressure on the permeate side of the at least one membrane and discharging the permeate from the membrane separation unit at an absolute pressure of 0.4 to 0.85 bar [0.65 bar in claim 70].

Thus, the present invention enriches the oxygen content of ambient air compressing it to an absolute pressure of 1.35 to 1.5 bar, permeating it through at least one membrane using a solubility-diffusion mechanism, and discharging the permeate at reduced absolute pressure of 0.4 to 0.85 bar/0.65 bar.

It is submitted that such a method is not comparable with that of Yee et al. who enrich the oxygen content of air at high temperature using inorganic oxide ceramic materials in the form of selectively permeable nonporous ion transport membranes (see, steps (c) and (d) of claims 1 and 18 of Yee et al.). In this regard, it is pointed out that the 500°C to 1200° C operating temperatures utilized by Yee et al. would destroy membranes of the type used in accordance with the present invention that operate on the basis of a solubility-diffusion mechanism. In addition to using a fundamentally different mechanism, Yee et al. compress the gas to a pressure above that at which the present invention delivers the air flow to the membrane separation unit and Yee et al. withdraw their oxygen enriched product at atmospheric, not subatmospheric, pressure (.85 bar is equal to 12.33 psi). Still further, while the present applicants enrich the oxygen concentration of the permeate by 22 to 45 volume percent, Yee et al. seek an oxygen enrichment of 98%.

Therefore, Yee et al. cannot even reasonably be said to render obvious the present invention, let alone anticipate it. Accordingly, the § 102 rejection based upon the Yee et al. patent should be withdrawn and such action is hereby requested.

Claims 29, 31, 33, 35, 36, 38-40, 43, 45, 46, 62, 63, and 65 were rejected under 35 USC § 102 based on the Nelson et al. patent, while claims 30 and 32 were considered to be unpatentable under § 103 based on this patent. However, to the extent that these rejections might relate to the claims as now presented, this rejection is inappropriate for the following reasons.

In particular, Nelson et al. fail to teach the use of membranes that operate on the basis of a solubility-diffusion mechanism, but rather gas separation “is believed to be primarily generated by Knudsen flow in the surface pores” of the substrate 12 (col. 5, lines 65-67). Furthermore, there is no teaching or suggestion to deliver a compressed air flow to a membrane separation unit at an absolute pressure of 1.35 to 1.5 bar, or to discharge the permeate at reduced absolute pressure of 0.4 to 0.85 bar/0.65 bar.

Accordingly, the Nelson et al. patent does not anticipate the present invention and cannot render it obvious, so that the §§ 102/103 rejections based thereon is requested to be withdrawn.

Claims 47-55, 57, 58, 60, 62, and 64-66 were rejected under 35 USC § 102 based on the Blackmer et al. patent. However, here again, to the extent that this rejection might relate to the claims as now presented, this rejection is inappropriate. That is, Blackmer et al. teach delivery of atmospheric air over their array of membranes with no suggestion whatsoever to compress the air to 1.34 to 1.5 bar before doing so as is the case for the present invention. Therefore, this rejection should also be withdrawn and action to that effect is hereby requested.

Claims 34, 37, 42, and 67 were rejected under 35 USC § 103 as being unpatentable over Yee et al. or Nelson et al. when viewed in combination with the Blackmer et al. patent, while claim 56 was rejection based only on the combination of the Blackmer et al. and Yee et al. patents. However, as should be apparent from the above comments, these three patents relate to processes that are different from each other and from the present invention so that combining of their teachings would not have been obvious, and even if combined in some manner, the result would still lack those characteristics of the present invention that cannot be found in any of these three references. As such, these rejections should also be withdrawn and such action is requested.


Claims 44 and 69 were rejected under 35 USC § 103 as being unpatentable over Yee et al. or Nelson et al. when viewed in combination with the Blackmer et al. patent and EP 0 362 436 (Campbell et al.). Campbell et al. is cited with respect to its teaching at col. 8, lines 4-27, to remove condensed water or other liquid from the separator. However, even if such a condensate removal technique were to be utilized in conjunction with the combined teachings of Yee et al. or Nelson et al. with the Blackmer et al. patent, all of the shortcomings of these references relative to the presently claimed invention, noted above, still would exist, so that the addition of Campbell et al. to this combination could not render the present invention obvious. Therefore, reconsideration and withdrawal of this rejection are also in order and now requested.

The references that have been cited but not applied by the Examiner have been taken into consideration. However, since these references were not found to be relevant enough by the

Examiner to apply against the original claims, no detailed comments thereon are believed to be warranted at this time.

Therefore, in the absence of new and more relevant prior art being discovered, this application should now be in condition for allowance and action to that effect is requested. However, while it is believed that this application should now be in condition for allowance, in the event that any issues should remain, or an new issues arise, after consideration of this response which could be addressed through discussions with the undersigned, then the Examiner is requested to contact the undersigned by telephone for the purpose of resolving any such issue and thereby facilitating prompt approval of this application.

Respectfully submitted,

By: 

David S. Safran
Registration No. 27,997

Customer No. 25570

Roberts Mlotkowski Safran & Cole, P.C.
P.O. Box 10064
McLean, VA 22102

Direct Telephone: (703) 584-3273

DSS:kmm